

# NATURAL RESOURCES CONSERVATION SERVICE

## CONSERVATION PRACTICE STANDARD

### WINDBREAK/SHELTERBELT ESTABLISHMENT

(Feet)

CODE 380

#### DEFINITION

Linear plantings of single or multiple rows of trees or shrubs or sets of linear plantings.

#### PURPOSES

- Reduce soil erosion from wind.
- Protect plants from wind related damage.
- Alter the microenvironment for enhancing plant growth.
- Manage snow deposition.
- Provide shelter for structures, livestock, and recreational areas.
- Enhance wildlife habitat by providing travel corridors.
- Provide living noise screens.
- Provide living visual screens.
- Provide living barriers against airborne chemical drift.
- Delineate property and field boundaries.
- Improve irrigation efficiency.
- Enhance aesthetics.
- Increase carbon storage.

#### CONDITIONS WHERE PRACTICE APPLIES

On any areas where linear plantings of woody plants are desired and suited.

#### CRITERIA

##### General Criteria Applicable to All Purposes

The location, layout and density of the planting will accomplish the purpose and function intended within a 20 year period.

The maximum design height (H) for the windbreak or shelterbelt shall be the expected height of the tallest row of trees or shrubs at age 20 for the given site.

Species must be adapted to the soils, climate and site conditions.

Species shall be suited for the planned practice purpose(s).

Site preparation shall be sufficient for establishment and growth of selected species, not contribute to erosion, and be appropriate for the site.

Only viable, high quality, and adapted planting stock or seed will be used.

The planting shall be done at a time and manner to insure survival and growth of selected species.

The planting will be protected from adverse impacts such as livestock damage or fire.

Avoid planting trees or shrubs where they will interfere with structures or utilities (either above or below ground).

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for the selected species.

Windbreaks are to be located across prevailing wind direction and, on hilly terrain, along the contour where possible.

Avoid locations which will create hazards to safety and health (road junctions, utility rights-of-way, etc.).

Where woodcrop production is a secondary objective, five or more rows should be planted to permit thinning and harvesting.

Roadways or lanes through windbreaks should be at an angle or curved.

**Table 1.**

<b>Trees and Shrubs</b>	<b>Avg. Effective<sup>1</sup> Height (ft.)</b>
American holly ( <i>Ilex opaca</i> )	20-30
Bayberry or Southern wax myrtle ( <i>Myrica sp.</i> )	15-20
Bronze elaeagnus ( <i>Elaeagnus pungens</i> ), evergreen	4-10
Bush honeysuckle <sup>2</sup> ( <i>Lonicera maackii</i> ), deciduous	8-12
Carolina laurelcherry ( <i>Prunus caroliniana</i> )	25-35
Chickasaw plum ( <i>Prunus angustifolia</i> )	15
Chinquapin ( <i>Castanea pumila</i> )	15-25
Crabapple ( <i>Malus angustifolia</i> )	15-20
Eastern redcedar ( <i>Juniperus virginiana</i> )	20-30
Loblolly pine ( <i>Pinus taeda</i> )	40-55
Longleaf pine <sup>3</sup> ( <i>Pinus palustris</i> )	25-35
Sawtooth oak ( <i>Quercus acutissima</i> )	25-35
Shrub lespedeza <sup>4</sup> ( <i>Lespedeza bicolor</i> ), deciduous	8-12
VA-70 or Amquail Shrub Lespedeza <sup>4</sup> ( <i>Lespedeza thunbergii</i> )	5-7
Yaupon holly ( <i>Ilex vomitoria</i> ) or Dahoon holly ( <i>Ilex cassine</i> ), evergreen	20-30

<sup>1</sup>Estimated height range of trees at 20 years of age; shrubs at maturity.

<sup>2</sup>Not evergreen, but normally in full leaf by critical wind erosion period.

<sup>3</sup>Plant containerized seedlings if possible. Underplant with a perennial shrub such as southern wax myrtle after majority of pines have broken out of the grass stage into active height growth.

<sup>4</sup>Not evergreen - should be planted in combination with evergreens.

### **Location and Distance between Windbreaks**

Use procedures outlined in the North Carolina Wind Erosion Handbook to calculate the area or distance sheltered. Determine the future height of the windbreak and its alignment to the prevailing wind. The formula of 10H (10 x

height of barrier) is used to determine distance sheltered.

In open fields, plant windbreaks at right angles (0-22 ½ degrees) to prevailing wind.

In fields protected by tree/shrub windbreaks in combination with minimum tillage, crop residue use, and/or wind stripcropping, distances between windbreaks may be left to the discretion of the owner.

### **Species**

Plant species adapted to the soil-site conditions. (See Section II-B of the Technical Guide – Woodland Suitability.) Species shown in Table 1 are generally suited to the Sandhills, Coastal Plain, and Flatwoods of North Carolina.

Species to plant should be selected from Table 1. Other locally-obtained native plant materials or volunteer vegetation that have the same growth rate, shape, and size are emphasized and may be used if available.

### **Spacing and Arrangement - multi-row windbreaks**

Spacing between individual plants shall be based on the needed growing space for plant type and species, the accommodation of maintenance equipment, and the desired characteristics of the stem(s), branches and canopy as required for a specific purpose.

Two or three rows of trees with rows 6 feet apart are most effective.

Pines should be no more than 8 feet apart in rows; redcedar, 5-6 feet. An example windbreak follows:

Plant one row (6 feet between trees) of eastern redcedar, two rows of loblolly pine or sawtooth oak (6 feet wide and 6 feet between trees), and interplant with shrub lespedeza after trees are established.

Stagger each tree in row between the trees of adjacent rows.

Where shrubs are used, plant a strip no less than 4 feet wide on the windward side of the field to be protected.

Plant shrubs at least 4 feet apart in the row.

Plant shrub lespedeza in rows two feet apart with individual plants 18 inches apart in the row.

Where a mixture of species are used in multiple-row windbreaks, plant a high crown

density species on the outside row on the windward side.

Where only shrubs are used in the windbreak, space shrubs 2 to 5 feet apart in each row.

Acceptable options for single row windbreaks include:

Eastern redcedar - 6 ft. spacing.

Loblolly pine - 8 ft. spacing and interplanted with a shrub.

Sawtooth oak - 10 ft. spacing and interplanted with a shrub.

Spacing between windbreaks and rows of windbreaks may be adjusted, within limits of the criteria above, to accommodate widths of equipment.

### **Site Preparation**

A suitable planting site should be prepared by eliminating competing vegetation. A sod lane should be plowed, worked thoroughly, and fallowed if necessary. Sod may also be controlled through use of approved herbicides.

### **Methods of Planting**

Mechanical tree planters may be used where soil erosion conditions and slope permit.

Hand planting - Use a planting bar (dibble), mattock, or shovel where it is impractical to use a machine planter. Planting bars work very well in lighter sandy soils. A plug dibble should be used for containerized seedlings.

Apply fertilizer according to soil test if available.

Where soil blowing will severely damage planted windbreak seedlings, establish temporary protection, such as a strip of abuzzi rye, prior to planting the tree or shrub seedlings. The woody species may be planted either within the rye strip or on the leeward side of it.

### **Additional Criteria to Reduce Wind Erosion, Protect Growing Plants**

The windbreak will be oriented as close to perpendicular to the troublesome wind as possible. The interval between windbreaks shall be determined using current, approved wind erosion technology. Interval widths shall not exceed that permitted by the soil loss tolerance (T), or other planned soil loss objective. Calculations shall account for the effects of other practices in the conservation management system.

The wind erosion control system should consider temporary measures (e.g. ground covers) to supplement the windbreak until it is fully functional.

Sites, fields, and plants are protected within an area 10 times the design height (H) on the leeward side and two times the design height (H) on the windward side of the windbreak.

### **Additional Criteria To Manage Snow**

The windbreak will be oriented as close to perpendicular to the snow-bearing wind as possible.

For snow accumulation, the minimum barrier density will be 50 percent (as viewed from the side) and the windward row will be at least 100 feet from the area to be protected.

Windbreaks will be located so that snow deposition will not pose a health or safety problem or obstruct human, livestock, or vehicular traffic.

### **Additional Criteria to Provide Shelter for Structures, Livestock, and Recreational Areas**

The planting will be oriented as close to perpendicular to the troublesome wind as possible.

For wind protection, the minimum barrier density will be 65 percent during the months of most troublesome wind and the area to be protected will fall within a leeward distance of 10 times the design height (H).

Drainage of snowmelt from the windbreak shall not flow across the livestock area.

Drainage of livestock waste from the livestock area shall not flow into the windbreak.

### **Additional Criteria for Providing or Enhancing Wildlife Habitat or Travel Corridors**

A minimum of 3 rows of trees and/or shrubs will be planted.

Interplant or underplant (depending on competition with primary windbreak species) grass/shrub species that provide food and shelter for the targeted wildlife species.

After survival and growth of the primary windbreak species are assured, discontinue routine mowing and weed control to allow invasion of naturally occurring plant species into the understory.

**Additional Criteria for Noise Screens**

Noise screens shall be at least 65 percent dense during all times of the year, as tall as, and as close to the noise source as practicable.

The length of the noise screen shall be twice as long as the distance from the noise source to the receiver.

For high-speed traffic noise, the barrier shall not be less than 65 feet wide. For moderate speed traffic noise, the barrier width shall not be less than 20 feet wide.

Species selected will be tolerant to noxious emissions, sand, gravel depositions or salt spray from traffic areas.

**Additional Criteria For Visual Screens**

Visual screens shall be located as close to the observer as possible with a density, height and width to sufficiently block the view.

**Additional Criteria to Improve Water Quality**

Fields subject to wind erosion that are upwind from streams or channels will be protected by windbreaks and/or other erosion control methods.

**Additional Criteria For Improving Irrigation Efficiency**

For sprinkler irrigation systems, the windbreak shall be as tall as the sprinkler heads.

The barrier shall not interfere with the operation of the irrigation system.

**Additional Criteria to Increase Carbon Storage**

Select plants that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

**CONSIDERATIONS**

Selection of plants for use in windbreaks should favor species or varieties tolerant to herbicides used in the area.

Plants which may be alternate hosts to undesirable pests should be avoided.

All plantings should complement natural features.

Tree or shrub rows should be oriented on or near the contour where water erosion is a concern. Where water erosion and/or runoff from melting snow is a hazard, it should be controlled by supporting practices.

Wildlife needs should be considered when selecting tree or shrub species.

Species diversity including use of native species, should be considered to avoid loss of function due to species-specific pests.

Field windbreaks are most often needed for the sandy (s class) soils of eastern North Carolina. However, many other coastal plain soils (e and w class) have a wind erosion hazard, and they also benefit from establishing field windbreaks. Windbreaks benefit crops, livestock, farmsteads, and homesites and therefore, should be considered in conservation planning in all geographic areas of North Carolina. They also provide air quality benefits that should be considered during the planning process.

When clearing forested land for agriculture, consider leaving windbreaks of native trees to provide wind erosion protection and wildlife travel lanes, feeding areas, nesting sites, and escape cover. Natural windbreaks offer immediate wind protection without the time lag of waiting for trees to grow.

Natural windbreaks consisting of native hardwoods, such as oak and gum, provide excellent wildlife habitat values. Natural windbreaks of 33 ft. to 330 ft. in width offer effective wind protection as well as wildlife escape cover and habitat and can also produce marketable timber products. The distance sheltered by natural windbreaks should be calculated using the same methods described above.

Consider the potential growth and future economic value of plants and trees, the plant's usefulness as food and cover for wildlife, and the appearance or beauty of the windbreak in the landscape.

When the windbreak is aligned near to right angles (zero up to 22 1/2 degrees) to the wind, there is no practical reduction in sheltered distance.

Windbreaks should be considered along farm boundaries, field boundaries, canal banks, public roads, private roads, or ridge tops.

## PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, technical notes, narrative statements in the conservation plan, or other acceptable documentation.

Minimum documentation for this practice includes: (This list will vary by practice)

- Species to be planted
- Plant spacing and arrangement
- Number of rows and distance between rows
- Site preparation and planting methods
- Method of planting
- Season of the year to be performed
- Soil amendments
- Cultural practices
- Statement requiring compliance with all federal, state, and local laws
- Operation and maintenance requirements

Specific pesticide recommendations will be obtained from personnel who are licensed by the NC Department of Agriculture and Consumer Services in specialty area Agricultural Pest Plant Category O - in accordance with North Carolina Pesticide Laws and Regulations.

**Note:** All pesticides must be registered for use by North Carolina and approved for use by the U. S. Environmental Protection Agency (EPA). Refer to the current issue of "North Carolina Agricultural Chemicals Manual" prepared by the College of Agriculture and Life Sciences, North Carolina State University, for guidelines, rules and regulations regarding use of pesticides. Users must **always** follow instructions and safety precautions on the container label when handling, applying, or storing pesticides.

## OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the

application and use of the practice (operation), and repair and upkeep of the practice (maintenance):

- Replacement of dead trees or shrubs will be continued until the barrier is functional.
- Vegetative competition will be controlled.
- Supplemental water will be provided as needed.
- Thin trees and shrubs from within the barrier if needed to maintain its function.
- Damaging pests will be monitored and controlled. Periodic applications of nutrients may be needed to maintain plant vigor. Note: prevent pesticides and fertilizer from contaminating surface water.
- Roots of established tree windbreaks may be pruned to reduce sapping effects on crops. Prune to a depth of 2 feet or more, parallel to the windbreak at a distance (from the windbreak) of one-half the total height of the trees at time of pruning.
- Prune with a ripper, chisel, subsoiler, or deep plow. Begin root pruning when trees are 4 to 6 years old.
- Thinning of interior rows only of multiple-row windbreaks of commercial sizes is acceptable provided careful attention is given to maintaining an effective crown density and minimizing damage to remaining trees.
- Reducing competition from weeds, grass or brush is important for the survival and growth of the windbreak seedlings. Competition can be reduced by mowing or spraying with an approved herbicide.
- Control competing vegetation as needed for at least two years after establishment. Modify spacing between rows to permit passage of equipment if necessary. Exercise care to prevent damage by mowing equipment and other farm equipment.
- Young trees must be protected from spray drift.
- Protect from fire and grazing by domestic livestock.
- Replace dead trees and shrubs with the same species the first year following planting.

**REFERENCES:**

- 1) Trees for Conservation: Planning, Planting, and Care. 1988. Colorado State Forest Service No. 114-1185.
- 2) Windbreaks for Conservation. 1997. USDA Natural Resources Conservation Service. AIB 339.
- 3) Windbreaks for Montana. 1986. Cooperative Extension Service, Montana State University, Bulletin 366.